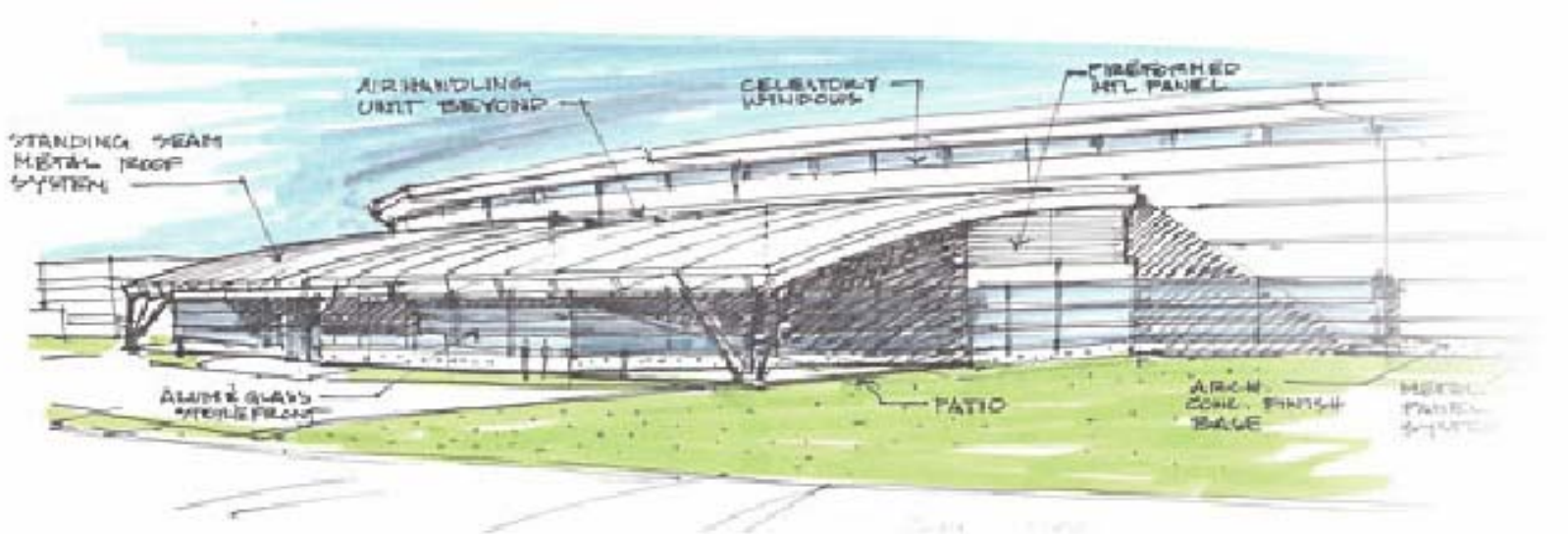
NSLS-II Requirements and Interfaces



Conventional Facilities Advisory Committee

25-26 September 2007

Erik Johnson
Accelerator Systems Interface Manager

Overview

- Requirements, Specifications and Interfaces (RSI) Concepts
- Discovery and Documentation Process
- Example from Accelerator Systems
  - Personnel Protection System
    - RF System Interface
    - Ring building Interface
- Plans for document development

Key Objectives for RSI Documentation

Provide a tool for Scope Management

- Complete, but not burdensome to implement
- Interactive - a real live document
- Up to date snapshots available to the project

Achieve Integration across the project

- Vertical (within WBS family)
- **Horizontal** (across WBS families)

Important first steps

- Adopt a common language across the project
- Employ the WBS as the information framework

RSI Definitions

Requirements:
functions a WBS Element needs to perform or needs to have performed for it to work as intended

- Two types; Basic and Derived
- Two directions; Imposed and Delegated

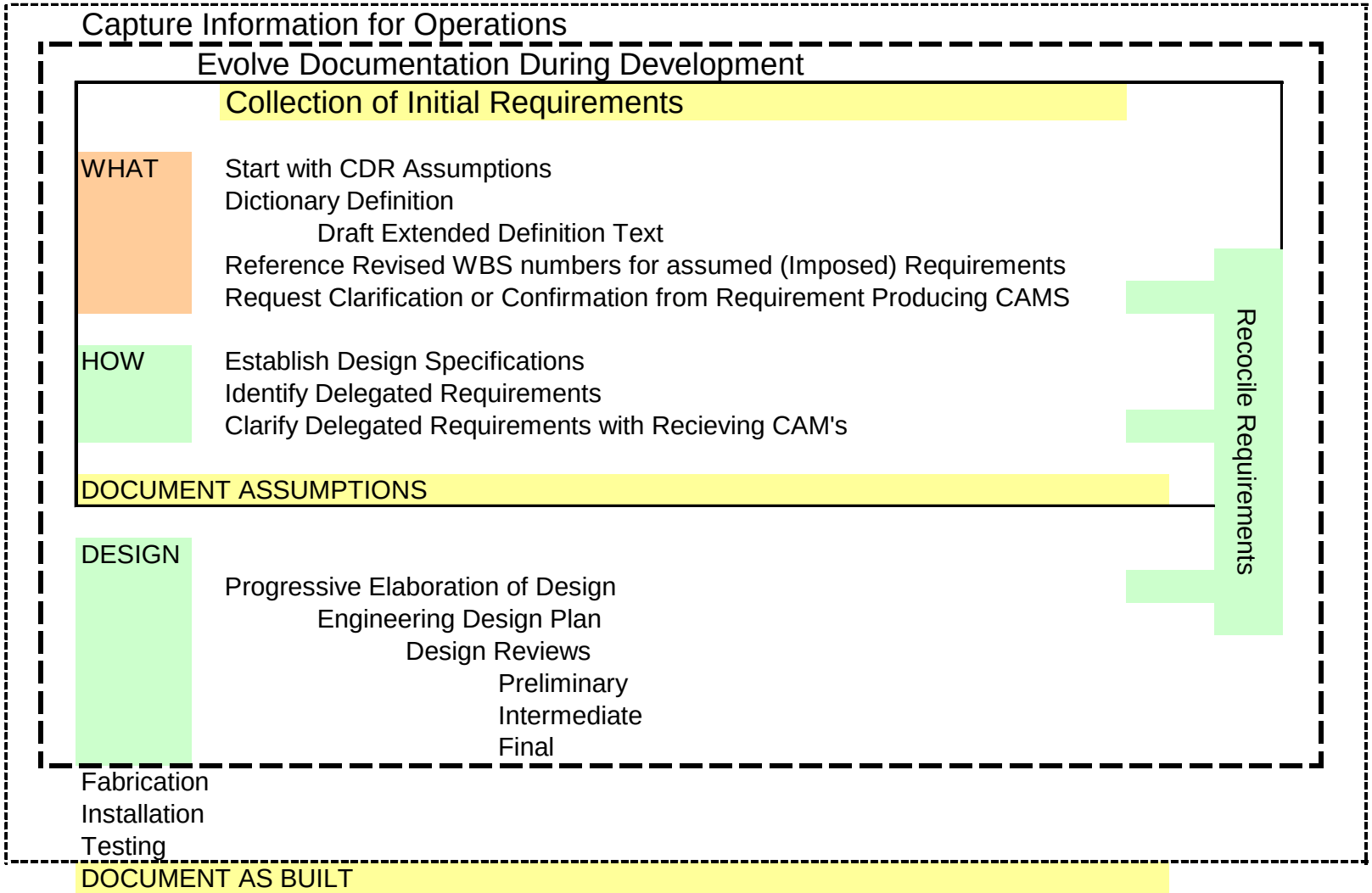
Specifications:
characteristics designed into WBS Element to satisfy the Imposed Requirements or result in Delegated Requirements

Interfaces:
boundary definitions between WBS Elements

Attributes of RSI System

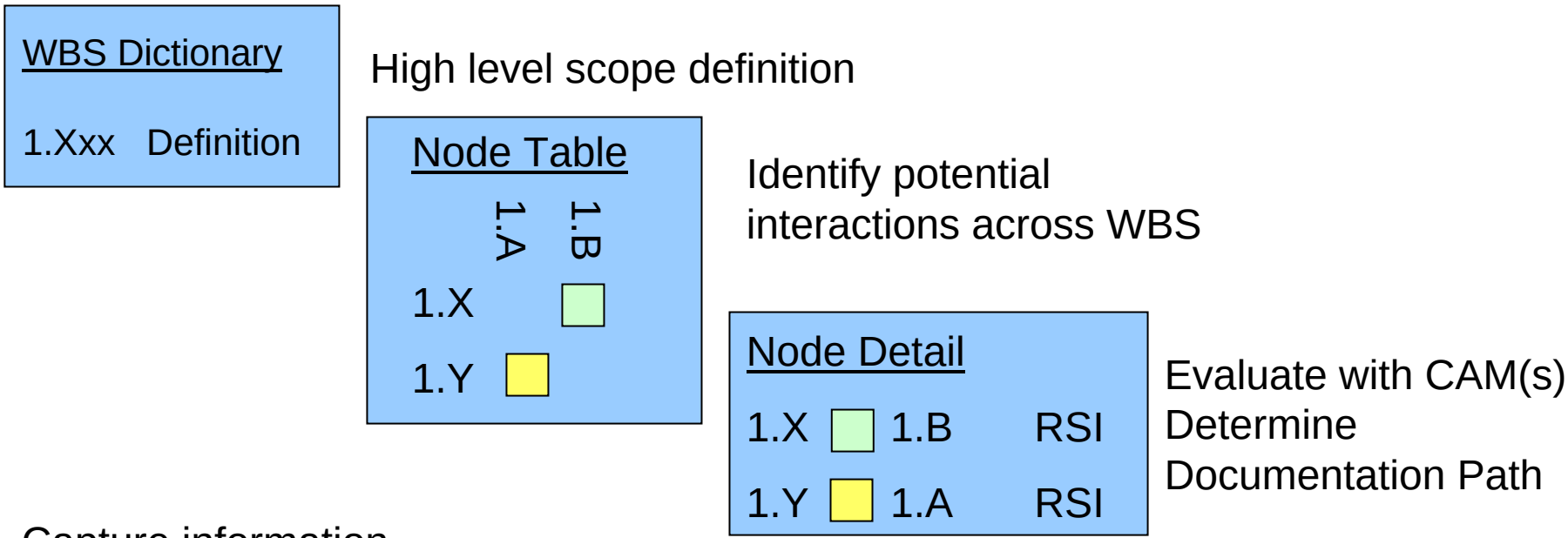
- Disciplined approach for capturing Requirements, Specifications and Interfaces
- Establishes relational database with tables for project-wide RSI information
- Provides project development Information
  - Query for specific information of interest
  - Reports as RSI Documents - Basis of Design
- *Shared technical information basis*

Evolution of NSLS-II Technical Documentation



Discovery and Documentation

- Starting assumption: CAM's conversant with their own system specifications (Vertical Integration)
- For discovery, focus on horizontal integration nodes



Capture information

'Simple' Integration: Node Report

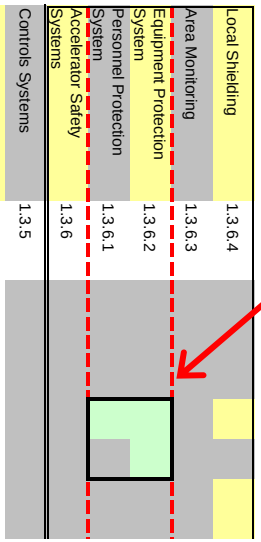
Complex Integration: Charrette Process

Simple Example: PPS/RF

Technical Interfaces Only - No Vertical Integration or Schedule Dependencies, Only first degree associations

From the perspective of the WBS elements in columns what kind of requirements? 1 (Red) is imposed, 2 (Green) is delegated, 3 (Straw) has both.

WBS	Working Title	Resp
1.3.4.6	Storage Ring RF Systems	19979
1.3.4.6.1	Storage Ring RF Cavities	19979
1.3.4.6.3	Storage Ring RF Vacuum System	14102
1.3.4.6.4	Storage Ring RF Power Systems	19979
1.3.4.6.5	Storage Ring Low Level RF	19979
1.3.4.6.6	Storage Ring RF Cryogenic System	14883



Partial Node Table for Accelerator Safety Systems

- Potential interface between PPS and RF system

Node Detail Table

- Describes in text and parameters interactions between elements

RSI Entry Form	Requirement	Specifications/ Requirements	
Serial Number	TBD	(assigned after entry) -1	(assigned after entry) -2
Title	Interfaces of PPS to storage ring Systems	Storage Ring low level RF to PPS interface	Storage Ring RF Power supply to PPS interface
Requirement/Spec'n	Specification	Specification	Specification
Requirement Author	Scott Buda	Scott Buda	Scott Buda
Description	Interaction of the PPS system with the critical devices and storage ring enclosure	PPS uses storage ring low level RF system and RF power system as a critical device to disable circulating beam in the storage ring.	PPS uses storage ring low level RF system and RF power system as a critical device to disable circulating beam in the storage ring.
Parameters			
Attribute	PPS functionality	Electrical Connection	Electrical Connection
Value		On/Off	On/Off
Units			
Qualifier	Other	Other	Other
References (WBS or Document)			
Reqmt From:	1.3.6.1		
To:		1.3.4.6.4	1.3.4.6.4
Applicability			
Comm'n	1	1	1
CD4b	1	1	1
Full Build	1	1	1
Requirement Status	Req	Req	Req
Notes:			
Text 1	Interfaces required for the PPS to provide protective functions	PPS provides cold contacts to the Storage ring low level RF system.	PPS provides cold contacts to the Storage ring RF system anode power supplies.
Text 2	Must reach to RF systems to provide critical beam inhibition device	Closed contact indicates OK to operate, open contact inhibits RF operation	Closed contact indicates OK to operate, open contact inhibits RF operation
Text 3	Must reach to dipole magnet supply to provide critical beam inhibition device		This system is actuated with a time delay after the low level RF system ihibit signal has been given
Text 4	Must have proper physical interfaces with the building to provide safety and security functions		

Integration Report

Accelerator Division Horizontal Integration Node

Interlocks

PPS uses storage ring low level RF system and RF power system as a critical device to disable circulating beam in the storage ring.

Dictionary Entries for Nodes

1.3.6.1 Personnel Protection System
Scott Buda

The PPS and all its components exclusive of hardware for beamline PPS interlocks. The design of these systems is captured and integrated into this WBS, but the cost modifications, hardware procurement, and installation for the beamlines are specified for each beamline in separate items.

1.3.4.6.4 Storage Ring RF Power Systems
Jim Rose

This is for RF power transmitters and the associated circulators, loads, driver amplifiers, and waveguides to power the RF cavities. Two turnkey 300 kW systems are in the baseline cost estimate, as well as a fast oscilloscope and a network analyzer. Travel costs for two trips to the vendor are included (kickoff and acceptance testing), and a full range of test equipment: two power meters, two small scopes, handheld meters, a digital signal analyzer, spectrum analyzer, and dynamic signal analyzer.

Cost Estimate Database Details

WBS Total	3.69	443,500	573,000	0	1,016,500	1.51	185,684	3,480,000	15,000	3,680,684

Activity	FTE	Labor	Matl	Travel	Total
PPS Accelerator Interlock - Conceptual Design with	0.07	9,240	0	0	9,240
PPS Accelerator Interlock - Revisit Estimate	0.02	3,080	0	0	3,080
PPS Accelerator Interlock - Define Specification f	0.05	6,160	0	0	6,160
PPS Accelerator Interlock - Preliminary Design w/	0.11	13,480	0	0	13,480
PPS Accelerator Interlock - Laboratory In-House Re	0.05	6,160	0	0	6,160
PPS Accelerator Interlock - Final Design	0.05	6,160	0	0	6,160
PPS Accelerator Interlock - Procurement	0.00	0	573,000	0	573,000
PPS Accelerator Interlock - Software Coding & PLC	0.16	20,800	0	0	20,800
PPS Accelerator Interlock - P1 & P5 MCC Interfaces	0.02	2,320	0	0	2,320
PPS Accelerator Interlock - Interface RF & PS to I	0.01	1,160	0	0	1,160
PPS Accelerator Interlock - Interface Booster to S	0.01	1,160	0	0	1,160

Activity	FTE	Labor	Matl	Travel	Total
Write Specification - SR RF Power System	0.75	93,756	0	0	93,756
Evaluation bid and award - SR RF Power System	0.05	6,468	3,480,000	0	3,486,468
Procurement - SR RF Power System	0.19	25,872	0	15,000	40,872
Oversee installation and acceptance tests - SR RF	0.52	59,588	0	0	59,588

- Collects elements of technical interface with cost and schedule
- Compares activities
- Clarify interfaces
- *Will be in data base for live updates*

Same Table, Different Interface

Technical Interfaces Only - No Vertical Integration or Schedule Dependencies, Only first degree associations

From the perspective of the WBS elements in columns what kind of requirements? 1 (Red) is imposed, 2 (Green) is delegated, 3 (Straw) has both.

			Controls Systems	Accelerator Safety Systems	Personnel Protection System	Equipment Protection System	Area Monitoring	Local Shielding
			1.3.5	1.3.6	1.3.6.1	1.3.6.2	1.3.6.3	1.3.6.4
WBS	Working Title	Resp						
1.4.5.6.7	Powder Diffraction Wiggler Beamline Equipment Protection System	20446						
1.5.3.3	Booster/Linac Operations Center (BLOC)	17711						
1.5.3.4	Ring Building	17711						
1.5.3.4.1	Pentant 1	17711						
1.5.3.5	Lab - Office Modules	17711						
1.5.3.6	Mechanical Utilities	17711						
1.5.3.7	Electrical Utilities	17711						
1.5.3.8	LN2 & GN2 Distribution System	14883						
1.5.3.9	Chilled Water	17711						

Node Detail Table

- This example shows PPS requirements for Conventional facilities (storage ring building)

Partial Node Table for Accelerator Safety Systems

- Potential interface between PPS and Conventional Facilities

RSI Entry Form		Requirement	Specifications/ Requirements
Serial Number		TBD	(assigned after entry) -6
Title		Interfaces of PPS to storage ring Systems	SR PPS interface to SR building
Requirement/Spec'n		Specification	Specification
Requirement Author		Scott Buda	Scott Buda
Description		Interaction of the PPS system with the critical devices and storage ring enclosure	Areas to be further detailed in development of conventional facilities for supporting PPS safety and security functions
Parameters			
	Attribute	PPS functionality	PPS functionality
	Value		
	Units		
	Qualifier	Other	Other
References (WBS or Document)			
Reqmt	From:	1.3.6.1	
	To:		1.5.3.4
Applicability			
	Comm'n	1	1
	CD4b	1	1
	Full Build	1	1
Requirement Status		Req	Req
Notes:			
	Text 1	Interfaces required for the PPS to provide protective functions	Storage ring enclosure needs to facilitate the installation and operation of the PPS system
	Text 2	Must reach to RF systems to provide critical beam inhibition device	The doors for access to the enclosure need to allow captured key locks and switches for the PPS system (this equipment is PPS scope). Specifications will be developed as the enclosure design is further elaborated.
	Text 3	Must reach to dipole magnet supply to provide critical beam inhibition device	Mounting surfaces for switches, gates, inspection mirrors, warning devices (signs, beacons, audible alarms) and cable conduits must be considered.
	Text 4	Must have proper physical interfaces with the building to provide safety and security functions	
	Text 5		
	Text 6		

Parameter Capture for Database

Field Name	Data Type	Description	Entry 1
Thread_key	Text	'Internal' key that could be included as needed for generating reports	STB
Sp_Thread_Key	Text	Spare 'internal' key	
Type	Text	Could be Key Parameter (DOE sensitive, CD0 related, Design (ie a choice), or Reference (a consequenc of other choices)	Design
Parameter Name	Text	Descriptive Name for the parameter being catalogued	Vibration Level (PSD)
ParameterDescription	Memo	Short Description of the parameter	Storage ring tunnel from 4-50 Hz
Owning WBS	Text	Level 2 or 3 WBS that owns or needs the parameter	1.0
SystemWBS	Text	WBS for system (or subsystem) that produces the parameter	1.5
Units	Text	The symbolic unit descriptor	nm
Quantifier	Text	Describing the natue of the parameter (nominal, min, max and so forth)	LT
Value	Number	Lower value if ramped, otherwise as specified by qualifier	25
Value_2	Number	Only available as Top of Ramp Value	
Qualifier	Text	Essentially the certianty of the paramter; preliminary, working or final. Entry indicates a parameter is being input and changes wouldn't create new records.	Entry
Tol_type	Text	If tolerance for value, wht kind ; bilateral or unilateral, value or percentage (BV, BP,UV,UP)	
Tol_val_1	Number	Value for bilateral tolerance, or 'plus' value for unilateral tolerance	
Tol_val_2	Number	Value for 'minus' side of unilateral tolerance	
Phase	Text	Project phase at which parameter is valid or required; Design, Commissioning, CD4A, CD4B, Capable, or Fault	Design
Notes	Memo	Note field to provide additional description as required	
Attach_1	OLE Object	Attachment field 1, could be pdf file with background information	
Attach_2	OLE Object	Attachment field 2, could be pdf file with background information	
Created_by	Text	Life Number of person entering or responsible for parameter	17897
Created_date	Date/Time	Timestamp for when the data was entered	
Modified_by	Text	Life Number of person entering modification	
Modified_date	Date/Time	Timestamp for when the data was modified	
Previous_record	Number	Capture the primary key number for the last revision	
Active_flag	Yes/No	Yes is currently active, No is retired record	Yes

Project Level Document Index

Global Requirements Documents		
1.0-1	NSLS-II Global Requirements Document	
1.0-2	Global Parameter List	
Accelerator Systems		
1.3-0.3	Injection System RSI Document	
1.3-0.4	Storage Ring RSI Document	
1.3-0.5	Controls RSI	
1.3-0.6	Accelerator Safety Systems RSI Document	
1.3-0.7	Insertion Device RSI Document	
Experimental Facilities		
1.4-0.2	Experimental Facilities Controls and Data Acquisition RSI Document	
1.4-0.3	Experimental Facilities Standard Diagnostics RSI Document	
1.4-0.4	Experimental Facilities Standard Optics RSI Document	
1.4-0.5	User Instrument RSI Document	
1.4-0.6	Beamline Front End User Requirements Document	
Conventional Facilities		
1.5-1	Conventional Facilities Requirements Document	HDR 90% T-I

Numbering linked to WBS elements

Enhanced References for Conventional Facilities

These WBS elements may have requirements related to the WBS elements at left																	
		Title	Conventional Facilities	Conventional Facilities Management	Conventional Facilities Engineering and Design	Conventional Facilities Construction	CF Construction Management	Improvements to Land	Site Preparation	Site Restoration and Landscaping	Booster/Linac Operations Center (BLOC)	Ring Building	Pentant 1	Pentant 2	Pentant 3	Pentant 4	Pentant 5
Section	Title	WBS	1.5	1.5.1	1.5.2	1.5.3	1.5.3.1	1.5.3.2	1.5.3.2.1	1.5.3.2.2	1.5.3.3	1.5.3.4	1.5.3.4.1	1.5.3.4.2	1.5.3.4.3	1.5.3.4.4	1.5.3.4.5
1.00	**CONVENTIONAL FACILITIES OVERVIEW**																
2.00	**SITE/CIVIL**																
3.00	**ARCHITECTURE**																
3.01	Design Criteria																
3.02	Architecture																
3.03	Functional Program																
3.04	Space Program																
3.05	Preliminary Design																
4.00	**LEED**																
5.00	**STRUCTURAL ENGINEERING**																
6.00	**HVAC SYSTEMS**																
7.00	**PLUMBING**																
8.00	**FIRE PROTECTION**																
9.00	**PROCESS SYSTEMS**																
10.00	**ELECTRICAL ENGINEERING**																
11.00	**ENVIRONMENTAL SAFETY AND HEALTH**																

WBS for CF is too coarse for some references

HDR 90% Title I sections as extension to WBS

Interface node for ring building architecture is referenced as : 1.5.3.4-3.02

Accelerator RSI Report Index

RSI	WBS	Title
1.3-0.3	1.3.3	Injection System
1.3-0.3.1	1.3.3.1	Linac
1.3-0.3.2	1.3.3.2	Booster System
1.3-0.3.3	1.3.3.3	Transport Lines
1.3-0.3.4	1.3.3.4	Injector Utility Distribution
1.3-0.3.5	1.3.3.5	Injector Installation
1.3-0.4	1.3.4	Storage Ring
1.3-0.4.1	1.3.4.1	Injection Straight
1.3-0.4.2	1.3.4.2	Storage Ring Magnet Subsystems
1.3-0.4.3	1.3.4.3	Storage Ring Vacuum System
1.3-0.4.4	1.3.4.4	Storage Ring Power Supplies
1.3-0.4.5	1.3.4.5	Storage Ring Beam Instrumentation
1.3-0.4.6	1.3.4.6	Storage Ring RF Systems
1.3-0.4.7	1.3.4.7	Beamline Front Ends
1.3-0.4.8	1.3.4.8	Storage Ring Utility Distribution
1.3-0.4.9	1.3.4.9	Storage Ring Installation
1.3-0.5	1.3.5	Controls Systems
1.3-0.5.1	1.3.5.1	Vacuum System Controls
1.3-0.5.2	1.3.5.2	Power Supply Controls
1.3-0.5.3	1.3.5.3	RF Systems Controls
1.3-0.5.4	1.3.5.4	Diagnostic Instrumentation Controls
1.3-0.5.5	1.3.5.5	Conventional Facility Controls Interface
1.3-0.5.6	1.3.5.6	Insertion Device Controls
1.3-0.5.7	1.3.5.7	Experimental Controls
1.3-0.5.8	1.3.5.8	PPS Computer Controls
1.3-0.5.9	1.3.5.9	EPS Computer Controls
1.3-0.5.10	1.3.5.10	Accelerator Control Room
1.3-0.5.11	1.3.5.11	Operations Applications
1.3-0.5.12	1.3.5.12	Timing System
1.3-0.5.13	1.3.5.13	Global Feedback System Computer Controls
1.3-0.5.14	1.3.5.14	Controls Systems Management

RSI	WBS	Title
1.3-0.6	1.3.6	Accelerator Safety Systems
1.3-0.6.1	1.3.6.1	Personnel Protection System
1.3-0.6.2	1.3.6.2	Equipment Protection System
1.3-0.6.3	1.3.6.3	Area Monitoring
1.3-0.6.4	1.3.6.4	Local Shielding
1.3-0.6.5	1.3.6.5	Integrated Testing of PPS, EPS, & AMS
1.3-0.7	1.3.7	Insertion Devices
1.3-0.7.1	1.3.7.1	Damping Wiggler
1.3-0.7.2	1.3.7.2	CPMU
1.3-0.7.3	1.3.7.3	EPU
1.3-0.7.4	1.3.7.4	3-Pole Wiggler
1.3-0.7.5	1.3.7.5	Measurement & Correction
1.3-0.7.6	1.3.7.6	ID Installation
1.3-0.7.7	1.3.7.7	Integrated Test

- RSI Reports (40)
- Grey headers ‘by hand’ (5) compilation of RSI Reports
- Lower level in WBS as reports when design requires further documentation
- Anticipate similar structure for Experimental and Conventional Facilities

Plans for Document Development

- Project Level RSI Documents
  - mostly data and drafts at this time
  - need to be completed prior to CD2 review
- Thus far RSI reports are a ‘desktop’ exercise
  - Port to database with access to CED information
- Discovery and Documentation of information
  - Continue working within technical areas
  - Continue with integration across project disciplines
  - Develop web interface to reports to allow ready access to project team (staff and reviewers!)